

REMARKS

Prior to this Amendment, claims 1-38 were pending. In this Amendment, claims 1-3, 8, 10, 13, 22, 25, 34, and 37 are amended, no claims are canceled, and new claims 39-43 are added so that claims 1-43 are pending and subject to examination on the merits.

Support for new claims 39-43 can be found throughout the specification, drawings, and claims as originally filed. No new matter is added.

Applicants note that an Information Disclosure Statement was filed on April 22, 2002. However, Forms PTO/SB/08A and PTO/SB/08B with the Examiner's initials indicating consideration of the references cited therein were not attached to the Office Action. *Applicants request that copies of these forms initialed by the Examiner be faxed to the undersigned's attention or provided with the next Office Action.*

A number of objections and rejections are made in the Office Action. Each objection/rejection is addressed in the order presented in the Office Action. Although a number of changes are made to the application in response to the objections/rejections, Applicants do not necessarily agree with the positions taken by the Examiner. Rather, the changes are made to expedite the prosecution of the application.

I. Drawings

On page 2 of the Office Action, the Examiner states that "Figures 1 and 3 should be designated by a legend such as --Prior Art-- because that which is old is illustrated."

Applicants traverse the requirement that Figures 1 and 3 be labeled as "prior art". Applicants have reviewed the specification in detail and cannot find the words "prior art" in its description of Figures 1 and 3. Accordingly, the requirement that Applicants admit that a specific Figure is "prior art" when no such admission has been made is *per se* improper. In addition, the description of Figure 3 is at page 7 of the specification and is in the "Detailed Description of the Specific Embodiments" section. The process flow shown in Figure 3 is

intended to be used in an embodiment of the invention and is not intended to be a prior art admission. Accordingly, withdrawal of the objection to the drawings is requested.

II. Specification

On pages 2 and 3 of the Office Action, the Examiner makes a number of objections to the specification for failing to provide proper antecedent basis for the claimed subject matter.

According to the Examiner, "Claim 3 recites the limitation of the amorphous silicon carbide capping layer having a dielectric constant of less than 3.5. However, the specification continually refers to the amorphous silicon carbide capping layer as having a dielectric constant of 'approximately 4.5'."

In response, "3.5" in claim 3 has been changed to --4.5--.

According to the Examiner, "Claim 10 recites the limitation of the ELK film having a dielectric constant of 'approximately 3.0 or less'. However, the specification defines an ELK ('extremely low dielectric constant) film as a dielectric film that has a dielectric constant of less than 2.5, while 'low dielectric constant materials' are films that have a dielectric constant between 2.5 and 3.0."

In response, "3.0" in claim 10 has been changed to --2.5--.

According to the Examiner, "Claims 15, 22, and 37 recite the limitation of depositing the capping layers at a temperature of 100-450°C. However, the specification only provides support for depositing the a-SiC layer at a temperature of 350-450°C and the carbon-doped oxide layer at a temperature of 300-450°C."

In response, the paragraph beginning at page 14, line 19 has been amended to include the temperature range of 100-450 °C.

According to the Office Action, "Claim 34 recites the limitation of the a-SiC layer having an etch selectivity of 40:1 to 1:1. The specification does not disclose the etch selectivity of a-SiC to any other material."

In response, claim 34 is amended to state that the etch selectivity is with respect to the ELK layer (see page 12, line 25 of the specification).

Lastly, the Examiner objects to the chemical formulas at page 13, lines 9-10 of the specification (see page 3 of the Office Action).

In response, the chemical formulas at page 13, lines 9-10 have been corrected in the manner suggested by the Examiner.

Withdrawal of the objections to the specification is requested.

III. Claim objections

On page 3 of the Office Action, the Examiner objects to the phrase “said amorphous, hydrogenated silicon carbide capping layer.”

In response, claim 3 is amended, and withdrawal of the objection to claim 3 is requested.

IV. 35 U.S.C. § 112, ¶1

Claims 3, 10, 11, 13, 15, 22, 34, and 37 are rejected under 35 USC 112, 1st paragraph. The Examiner makes a number of specific objections.

On page 4 of the Office Action, the Examiner states that “Claim 3 recites a limitation of the amorphous silicon carbide capping layer having a dielectric constant of less than 3.5. However, the specification continually refers to the amorphous silicon carbide capping layer as having a dielectric constant of ‘approximately 4.5’.”

In response, “3.5” in claim 3 is amended to --4.5--.

The Examiner states “Claim 10 recites the limitation of the ELK film having a dielectric constant of ‘approximately 3.0 or less’. However, the specification defines an ELK (‘extremely low dielectric constant) film as a dielectric film that has a dielectric constant less than 2.5, while ‘low dielectric constant materials’ are films that have a dielectric constant between 2.5 and 3.0. Claim 11 is rejected for being dependent upon claim 10.”

In response, “3.0” in claim 10 has been changed to --2.5--.

The Examiner states “Claim 13 recites the limitation of the silicon carbide layer being formed by a silane-comprising precursor. However, the specification does not disclose using silane (SiH_4) to deposit the silicon carbide layer. Instead, the specification discloses using

organosilane precursors, which are silane-based compounds, but do not actually contain the silane (SiH_4) molecule (pg. 13, ln. 4-21)."

In response, claim 13 is amended to change "silane" to an --organosilane compound--.

The Examiner states "Claims 15, 22, and 37 recite the limitation of depositing the capping layers at a temperature of 100-450°C. However, the specification only provides support for depositing the a-SiC layer at a temperature of 350-450°C and the carbon-doped oxide layer at a temperature of 300-450°C".

In response, the paragraph beginning at page 14, line 19 has been amended to include the temperature range of 100-450 °C.

The Examiner states "Claim 34 recites the limitation of the a-SiC layer having an etch selectivity of 40:1 to 1:1. The specification does not disclose the etch selectivity of a-SiC to any other material."

In response, claim 34 is amended to state that the etch selectivity is with respect to the ELK layer (see page 12, line 25 of the specification).

Withdrawal of the rejection under 35 USC 112, ¶1 is requested.

V. 35 U.S.C. § 112, ¶2

Claims 1-22, 34, and 37 are rejected as indefinite. A number of specific objections are made and each objection will be addressed in the order presented.

On page 5 of the Office Action, the Examiner objects to the language "silicon carbide type" in claim 1.

In response, the word "type" is deleted from claim 1.

The Examiner also objects to the language "another stack consisting of said ELK film and a carbon-doped silicon oxide capping layer" in claim 2.

In response, claim 2 is amended to delete the phrase "another stack".

The Examiner objects to specific phrases in claims 22, 34, and 37.

In response, claims 22, 34, and 37 are amended.

Withdrawal of the rejection under 35 USC 112, ¶2 is requested.

VI. 35 U.S.C. § 103

A. Annapragada et al. (U.S. Patent No. 6,140,221) and Forbes et al. (U.S. Patent No. 5,926,740)

According to the Examiner, claims 1, 10, 11, 17-19, 23, 26-29, and 38 are obvious in view of Annapragada et al. and Forbes et al. According to the Examiner,

Annapragada discloses forming an extremely low dielectric constant (ELK) film (22) on a substrate (20). ... Annapragada does not disclose forming an amorphous silicon carbide capping layer on [an] ELK film. Forbes discloses a photolithography process wherein an antireflective coating is deposited between the layer to be etched and the photoresist mask layer. The antireflective coating (ARC) comprises a bottom layer of amorphous silicon carbide (105) and an upper layer of silicon oxycarbide (110) (col. 8, ln. 46-col. 9, ln 60). Forbes discloses that this antireflective coating is extremely useful in preventing light from the photolithography process from reaching the underlying material, whereby the resolution of the photolithography process is greatly improved, resulting in higher density circuits being able to be formed (col. 3, ln. 26-50). Forbes states that this ARC layer is appropriate to use in the formation of interconnection layers wherein underlying metal is usually highly reflective (col. 3, ln. 40-47). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ARC film of Forbes when conducting the photolithography process of etching the ELK layer of Annapragada because Forbes teaches that the ARC layer advantageously improves the quality of a photolithography process, thereby allowing higher density devices to be formed. Furthermore, Annapragada states that the material underlying the photoresist includes metal (124) and Forbes discloses that the ARC is especially useful when underlying materials include metal, which is highly reflective.

1. There is no motivation to modify Annapragada et al. in the manner suggested in the obviousness rejection

Obviousness has not been established with respect to the rejected claims. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). MPEP § 2143.01. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Here, there is no suggestion in the cited art to modify Annapragada et al. in the manner suggested by the Examiner. According to the Examiner, "Annapragada et al. teaches a "low dielectric constant (ELK) film (22) on a substrate (20)." According to Annapragada et al., "(22)" is a porous dielectric layer formed using a variety of dielectric materials including, for example, SiO₂, SiN, and SiON (see col. 3, lines 46-48). According to the Examiner, it would have been obvious for one to have deposited the SiC first layer 105 and the SiOC second layer 110 described in Forbes et al. on the porous dielectric layer (22) in Annapragada et al., because "Forbes states that this ARC layer is appropriate to use in the formation of interconnection layers where underlying metal is usually highly reflective (col. 3, ln. 40-47)" and because "Forbes discloses that the ARC is especially useful when underlying materials include metal, which is highly reflective."

Applicants submit that the porous dielectric layer (22) in Annapragada et al. is not an underlying metal layer, but is a porous dielectric material such as SiO₂, SiN, or SiON. Although FIG. 1B of Annapragada et al. shows a conductive structure (24) under a photoresist layer (21), the conductive structure (24) is covered by the porous dielectric layer (22). There is no motivation in the cited art to use the SiC or SiOC anti-reflective coatings in Forbes et al. in between the porous dielectric layer (22) and the photoresist layer (21) in Annapragada et al., because many of the materials suggested for use in the porous dielectric layer (22) in Annapragada et al. already have anti-reflective properties. For example, col. 2, lines 7-10 and col. 4, line 7 of U.S. Patent No. 6,153,504 (attached hereto) state that nitrides of silicon (e.g., SiON) are often used as anti-reflective materials in anti-reflective coatings. Since the majority of specific examples of the porous dielectric layers (22) in Annapragada et al. already have some

anti-reflective properties, Annapragada et al. teaches away from the modification proposed by the Examiner.

2. Improper hindsight was used to combine Annapragada et al. and Forbes et al.

The obviousness rejection is improper, because improper hindsight was used to combine Annapragada et al. and Forbes et al. In arriving at the obviousness determination, Applicants' claims were improperly used as a guide through a maze of prior art references to achieve the result of the claims, because Forbes et al. and Annapragada et al. are directed to very different inventions. Forbes et al. is directed to a "graded anti-reflective coating for IC lithography" (title). In contrast, Annapragada et al. fails to state or suggest that reflection during a lithography process is a problem to be solved, or that any anti-reflective coating would be beneficial. Annapragada et al. is directed to a method for forming vias through a porous dielectric material (title). In contrast, Forbes et al. fails to state or suggest that forming vias through porous dielectric materials is a problem to be addressed. In fact, Forbes et al. fails to mention porous dielectric materials at all. In view of the vast differences in the teachings in Annapragada et al. and Forbes et al., the only way one skilled in the art would have combined these references is if she had had the benefit of Applicants' disclosure as a blueprint to piece together the prior art. One looking at only the cited references would not have combined them in the manner suggested by the Examiner, absent improper hindsight.

Moreover, as noted above, the motivation to combine Annapragada et al. and Forbes et al. is inconsistent with the teachings in Annapragada et al. This further supports a conclusion that improper hindsight was used to combine Annapragada et al. and Forbes et al. Accordingly, withdrawal of the obviousness rejection is requested.

B. Annapragada et al., Forbes et al., and Xu et al.

According to the Examiner, claims 4-9, 30, 35, and 36 are obvious over Annapragada et al., Forbes et al., and Xu et al.

Applicants submit that the combination of Annapragada et al. and Forbes et al. is deficient for the reasons provided above, and that the additional citation of Xu et al. fails to remedy the problem of the improper combination of Annapragada et al. and Forbes et al.

C. Annapragada et al., Forbes et al., and Loboda et al. (*J. Vac. Sci. Technol. A* 12(1), pp. 90-96)

According to the Examiner, claims 12, 14-16, 24, 25 are obvious over Annapragada et al., Forbes et al., and Loboda et al. (*J. Vac. Sci. Technol. A* 12(1), pp. 90-96).

Applicants submit that the combination of Annapragada et al. and Forbes et al. is deficient for the reasons provided above, and that the additional citation of Loboda et al. fails to remedy the problem of the improper combination of Annapragada et al. and Forbes et al.

D. Annapragada et al., Forbes et al., and Loboda et al. (Electrochemical Society Proceedings Volume 98-6, pp. 145-152)

According to the Examiner, claims 20, 21, and 31 are obvious over Annapragada et al., Forbes et al., and Loboda et al. (Electrochemical Society Proceedings Volume 98-6, pp. 145-152).

Applicants submit that the combination of Annapragada et al. and Forbes et al. is deficient for the reasons provided above, and that the additional citation of Xu et al. fails to remedy the problem of the improper combination of Annapragada et al. and Forbes et al.

E. Annapragada et al., Forbes et al., Xu et al., and Loboda et al. (Electrochemical Society Proceedings Volume 98-6, pp. 145-152)

According to the Examiner, claims 32-33 are obvious over Annapragada et al., Forbes et al., Xu et al., and Loboda et al. (Electrochemical Society Proceedings Volume 98-6, pp. 145-152).

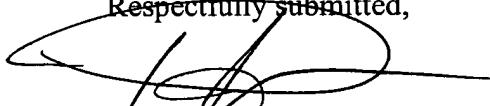
Applicants submit that the combination of Annapragada et al. and Forbes et al. is deficient for the reasons provided above, and that the additional citation of Xu et al. fails to remedy the problem of the improper combination of Annapragada et al. and Forbes et al.

CONCLUSION

In view of the foregoing, Applicants would submit that there are many more reasons why one would conclude that the present claims are patentable over the prior art, rather than unpatentable. Accordingly, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 707-745-5549.

Respectfully submitted,



Patrick Jewik
Reg. No. 40,456

VERSION WITH MARKINGS SHOWING CHANGES

IN THE SPECIFICATION

Page 13, line 4 has been amended as follows:

Table 2 below shows the process parameters used in a chamber that allows the film to be used as a capping layer in accordance with specific embodiments of the present invention. In the embodiments tested, the silicon and carbon were derived from a common compound, such as an organosilane-based compound. However, the carbon could be supplemented with other compounds, such as methane. Without limitation, suitable silane-based compounds could include: methylsilane (CH_3SiH_3), dimethylsilane [$(\text{CH}_3)_2\text{SiH}_3$] $(\text{CH}_3)_2\text{SiH}_2$, trimethylsilane [$(\text{CH}_3)_3\text{SiH}_3$] $(\text{CH}_3)_3\text{SiH}$, diethylsilane $(\text{C}_2\text{H}_5)_2\text{SiH}_2$, propylsilane $\text{C}_3\text{H}_8\text{SiH}_3$, vinyl methylsilane $(\text{CH}_2=\text{CH})\text{CH}_3\text{SiH}_2$, 1, 1, 2,2-tetramethyl disilane $(\text{HSi}(\text{CH}_3)_2-\text{Si}(\text{CH}_3)_2\text{H})$, hexamethyl disilane $(\text{CH}_3)_3\text{Si}-\text{Si}(\text{CH}_3)_3$, 1, 1, 2, 2, 3, 3-hexamethyl trisilane $(\text{H}(\text{CH}_3)_2\text{Si}-\text{Si}(\text{CH}_3)_2-\text{SiH}(\text{CH}_3)_2)$, 1, 1, 2, 3, 3-pentamethyl trisilane $(\text{H}(\text{CH}_3)_2\text{Si}-\text{SiH}(\text{CH}_3)-\text{SiH}(\text{CH}_3)_2)$, and other silane related compounds. In addition to organosilanes exemplified by the above list, organosiloxanes such as tetramethyl cyclotetrasiloxane may be used, with or without the addition of another oxygen source, for the deposition of CDO type caps. For the purpose of this invention, the term "organosilane" as used herein includes any silane-based compound having at least one carbon atom attached, including the preceding list, unless otherwise indicated. In Table 2, the compound used was trimethylsilane ("3MS"). A process gas, such helium, nitrogen, or oxygen was present and might assist in stabilizing the process, although other gases could be used.

Page 14, line 19 has been amended as follows:

To form the capping layer in the preferred process regime, a silicon source such as trimethylsilane may be supplied to a plasma reactor, specifically a reaction zone in a chamber that is typically between the substrate surface and the gas dispersion element, such as a "showerhead," commonly known to those with ordinary skill in the art. Typical commercial

PECVD chambers that may be used to practice embodiments of this invention to cap an ELK film, are the DxZ and Producer chambers produced by Applied Materials, Inc. of Santa Clara, California. Alternately, the entire stack (i.e. formation of ELK film and PECVD cap) may be formed in an integrated atmospheric deposition and vacuum cap system as described above. The sequence of operation of a commercial PECVD chamber is well known and needs no explanation for the embodiments of the present invention process regimes. The capping layer may be deposited at a temperature from 100-450 °C.

IN THE CLAIMS

The claims have been amended as follows.

1 1. (Amended) A process for capping an extremely low dielectric constant
2 ("ELK") film [using a silicon carbide type film] comprising:
3 forming an ELK film on a substrate; and
4 depositing an amorphous silicon carbide capping layer on said ELK film.

1 2. (Amended) The process of claim 1 [wherein a combined dielectric
2 constant of a stack consisting of said ELK film and said amorphous silicon carbide capping layer
3 is lower than a combined dielectric constant of another stack consisting of said ELK film and]
4 further comprising forming a carbon-doped silicon oxide capping layer on the amorphous silicon
5 carbide capping layer, wherein the carbon-doped oxide layer [which] has a dielectric constant
6 less than the dielectric constant of the amorphous silicon carbide capping layer.

1 3. (Amended) The process of claim 1 wherein said amorphous[,
2 hydrogenated] silicon carbide capping layer is hydrogenated, and has a dielectric constant [of]
3 less than approximately [3.5] 4.5.

1 4. (Unamended) The process of claim 1 wherein said amorphous silicon
2 carbide capping layer is copper diffusion resistant.

1 5. (Unamended) The process of claim 1 wherein said amorphous silicon
2 carbide capping layer does not adversely react with said ELK film to substantially degrade said
3 ELK film's dielectric property.

1 6. (Unamended) The process of claim 1 wherein said amorphous silicon
2 carbide capping layer has an adhesion strength to said ELK film of greater than 35 MPa.

1 7. (Unamended) The process of claim 1 wherein said amorphous silicon
2 carbide capping layer permits no substantial penetration of moisture.

1 8. (Amended) The process of claim 1 wherein a combined dielectric constant
2 for a stack [consisting of] comprising said ELK film and said silicon carbide capping layer [to
3 be] is less than 3.0.

1 9. (Unamended) The process of claim 8 wherein the combined dielectric
2 constant is less than 2.5.

1 10. (Amended) The process of claim 1 wherein said ELK film has a dielectric
2 constant of approximately [3.0] 2.5 or less.

1 11. (Unamended) The process of claim 10 wherein said ELK film has a
2 dielectric constant of approximately 2.5 or less.

1 12. (Unamended) The process of claim 1 wherein said amorphous silicon
2 carbide capping layer is an amorphous, hydrogenated silicon carbide layer deposited by:
3 introducing a silicon containing precursor, a carbon containing precursor, and a
4 carrier gas into a chamber; and
5 applying energy to react said silicon containing precursor and said carbon
6 containing precursor to deposit said amorphous, hydrogenated silicon carbide capping layer on
7 said ELK film in a non-oxidizing environment.

1 13. (Amended) The process of claim 12 wherein said silicon containing
2 precursor comprises [silane] an organosilane compound.

1 14. (Unamended) The process of claim 12 wherein said silicon containing
2 precursor and carbon containing precursor are derived from a common organosilane precursor.

1 15. (Unamended) The process of claim 12 wherein said silicon carbide
2 capping layer is deposited at a temperature of between approximately 100° to 450°C.

1 16. (Unamended) The process of claim 12 wherein applying energy comprises
2 generating a plasma in said chamber.

1 17. (Unamended) The process of claim 1 further comprising depositing a
2 carbon-doped oxide layer on said amorphous silicon carbide capping layer.

1 18. (Unamended) The process of claim 17 wherein said carbon-doped oxide
2 layer is a carbon-doped silicon oxide layer formed by:

3 introducing a silicon containing precursor, a carbon containing precursor, and a
4 process gas into a chamber, said process gas including oxygen; and

5 providing a plasma in said chamber to react said silicon containing precursor and
6 said carbon containing precursor in the presence of said plasma to deposit said carbon-doped
7 silicon oxide layer on said amorphous silicon carbide capping layer

1 19. (Unamended) The process of claim 18 wherein said oxygen is introduced
2 at a rate to produce an oxygen-starved plasma for depositing said carbon-doped silicon oxide
3 layer.

1 20. (Unamended) The process of claim 18 wherein said silicon containing
2 precursor and carbon containing precursor are derived from a common organosilane precursor.

1 21. (Unamended) The process of claim 20 wherein said organosilane
2 precursor is provided at a rate approximately six times that of the flow of oxygen gas.

1 22. (Amended) A process for capping an extremely low dielectric constant
2 (“ELK”) film using a silicon carbide material comprising:
3 forming an ELK film on a substrate; and

4 depositing a silicon carbide capping layer having a dielectric constant of
5 approximately less than 5 on said ELK film, where said silicon-carbide layer is produced by a
6 process providing a silicon containing precursor, a carbon containing precursor and process
7 gases comprising oxygen, helium and nitrogen [at rates of 0-400 sccm, 0-5000 sccm, and 0-5000
8 sccm respectively for the process gases], and providing said silicon containing precursor and said
9 carbon containing precursor at a rate approximately six times that of the oxygen and further
10 comprising reacting said silicon and said carbon containing precursor in a chamber having a
11 pressure in the range of about 1 to 15 Torr with an RF power source supplying a power at
12 approximately 300-600 watts and a substrate surface temperature between approximately 100°
13 and approximately 450° C and having a shower head to substrate spacing of approximately 200
14 to approximately 600 mils, and wherein said capping layer has an adhesion strength of at least
15 about 35 MPa to said ELK film, and wherein the dielectric constant [of the] for a stack consisting
16 of said ELK film and said silicon carbide layer is at most approximately 3.0.

1 23. (Unamended) A stack having a capped extremely low dielectric constant
2 ("ELK") layer, comprising:
3 a substrate;
4 an ELK layer formed on said substrate;
5 an amorphous silicon carbide layer deposited on said ELK layer; and
6 a carbon-doped oxide layer deposited on said amorphous silicon carbide layer.

1 24. (Unamended) The stack of claim 23 wherein said amorphous silicon
2 carbide layer is an amorphous, hydrogenated silicon carbide layer having less than about 5
3 atomic % oxygen.

1 25. (Amended) The stack of claim 24 wherein said amorphous[,
2 hydrogenated] silicon carbide layer is a hydrogenated amorphous silicon carbide layer that has
3 substantially no oxygen.

1 26. (Unamended) The stack of claim 23 wherein said amorphous silicon
2 carbide layer is deposited from a silicon-containing and carbon-containing precursor in a
3 non-oxidizing environment.

1 27. (Unamended) The stack of claim 23 wherein said carbon-doped oxide
2 layer is a carbon-doped silicon oxide layer.

1 28. (Unamended) The stack of claim 23 wherein said carbon-doped oxide
2 layer comprises about 30-50 atomic % oxygen.

1 29. (Unamended) The stack of claim 23 wherein said carbon-doped oxide
2 layer comprises about 10-30 atomic % carbon.

1 30. (Unamended) The stack of claim 23 wherein said amorphous silicon
2 carbide layer has an effective dielectric constant of approximately less than 5.

1 31. (Unamended) The stack of claim 23 wherein said carbon doped oxide
2 layer has an effective dielectric constant of approximately less than 3.5.

1 32. (Unamended) The stack of claim 23 wherein said stack has a combined
2 dielectric constant of approximately less than 3.

1 33. (Unamended) The stack of claim 32 wherein said stack has a combined
2 dielectric constant of approximately less than 2.5.

1 34. (Amended) The stack of claim 23 wherein said amorphous silicon carbide
2 layer comprises an etch selectivity ratio of between about 40 to 1 and about 1 to 1, with respect
3 to the ELK layer.

1 35. (Unamended) The stack of claim 23 wherein said amorphous silicon
2 carbide layer has an adhesion strength to said ELK layer of at least about 35 MPa.

3 36. (Unamended) The stack of claim 23 wherein said amorphous silicon
4 carbide layer is a moisture resistant layer.

1 37. (Amended) The stack of claim 23 wherein said carbon-doped oxide layer
2 is produced by a process providing a silicon containing precursor, a carbon containing precursor
3 and process gases comprising oxygen, helium and nitrogen [at rates of 0-400 sccm, 0-5000 sccm,

4 and 0-5000 sccm respectively for the process gases], and providing said silicon containing
5 precursor and said carbon containing precursor at rate approximately six times that of the oxygen
6 and further comprising reacting said silicon and said carbon containing precursor in a chamber
7 having pressure in the range of about 1 to 15 Torr with an RF power source supplying a power at
8 a rate of approximately 300-600 watts and a substrate surface temperature between
9 approximately 100° and approximately 450° C and having a shower head to substrate spacing of
10 approximately 200 to approximately 600 mils.

1 38. (Unamended) The stack of claim 23 wherein said carbon-doped oxide
2 layer is produced in an oxygen-starved plasma.

3 39. (New) A process for capping a low dielectric constant film, the method
4 comprising:

5 forming a porous, low-dielectric constant film on a substrate; and
6 depositing a capping layer on the low-dielectric constant film, wherein the
7 capping layer comprises a carbon-doped oxide or an amorphous silicon carbide film, and
8 wherein the capping layer has a dielectric constant of about 5.0 or less.

1 40. (New) The process of claim 39 wherein the capping layer has a dielectric
2 constant of about 4.5 or less.

1 41. (New) The process of claim 39 wherein the capping layer is in direct
2 contact with the porous, low-dielectric constant film.

1 42. (New) The process of claim 39 wherein the porous, low-dielectric constant
2 film has a dielectric constant less than about 2.5.

1 43. (New) The process of claim 39 wherein the porous, low dielectric constant
2 film and the capping layer are in a stack of layers, and wherein the stack of layers has an
3 effective dielectric constant less than about 3.0.